DRAFT INFORMATION CIRCULAR

New Jersey Geological Survey &
Bureau of Safe Drinking Water

Arsenic Water Treatment for Residential Wells in New Jersey

Arsenic has been found to occur in well water of the Piedmont Physiographic Province of New Jersey at levels exceeding the drinking water standard (Figure 1). Research by the NJ Geological Survey (NJGS) indicates the arsenic is predominantly naturally occurring.

Arsenic in well water is colorless, odorless, and tasteless. The only way to identify its presence in water is to have the water specifically tested for arsenic.

Arsenic is a toxic element that is known to increase the risk of adverse health effects in people who drink water containing it. Arsenic is a known human carcinogen that causes cancer of the skin, bladder, lung, kidney, and liver. It also causes increased risk of cardiovascular disease, peripheral neuropathy, skin hyperpigmentation and keratoses, and diabetes. Though the major exposure pathway for arsenic in residential well water is drinking and cooking with the untreated water, there may also be exposure from other uses of water in the home (for example, bathing, showering, and brushing teeth). The United States Environmental Protection Agency has lowered the arsenic drinking water standard from 50 parts per billion (ppb) to 10 ppb effective in January 2006. The NJ Department of Environmental Protection (NJDEP) has proposed setting the standard at 5 ppb.

Sample your well water for arsenic. If you have your own well and live in the shaded area of the map in Figure 1, you should have your water tested for arsenic. Water testing labs can usually be found in the yellow pages under "Laboratories-Testing" or "Water Analysis." A list of certified labs can also be found on the Private Well Testing Act web site at http://www.state.nj.us/dep/pwta/. Use a lab that is certified to test drinking water for arsenic. The best test methods are EPA Methods 200.8 (ICP/MS) and 200.9 (AA), and Standard Methods SM 3113B and SM 3114B. EPA Method 200.7 (ICP/AES) is not recommended due to relatively high method detection limits and EPA is removing it from the approved list. Use a lab that can provide a method detection limit (MDL) of 3 ppb or lower. The lab will report total arsenic. Although arsenic in New Jersey well water has been found to occur in two species commonly referred to as As3 and As5, the tests for these species are difficult and not widely available from commercial labs at this time. For this reason, it is important to choose a treatment system that removes both arsenic species.

PIEDMONT PHYSIOGRAPHIC PROVINCE
Fig 1

Re-sample your well water for arsenic. If you have tested your well and the arsenic level is reported to be greater than 5 ppb, you should re-test to confirm the result before obtaining a treatment system.

NJDEP conducted research to determine the most efficient, cost effective, user friendly, and environmentally sound water treatment technologies to remove arsenic from residential well water in New Jersey. Arsenic removal requires special considerations. Water softeners and granular activated carbon do not remove arsenic.

Granular Ferric Adsorption: **A whole-house granular ferric adsorption system is the preferred treatment technology.** It effectively removes both arsenic species from all water in the home, is easy to operate and maintain, and the arsenic is not returned to the environment via regeneration. This type of system is called a "Point-of-Entry" system because the water is treated where it enters the home and all the water in the home is treated. This type of system should be installed as shown in Figure 2. The system consists of a shut-off valve, a 5-micron sediment pre-filter, a raw water sampling tap, two 10x40 inch or 9x48 inch tanks each containing at least one cubic foot of adsorption media, backwash control valves on each tank, a sampling tap between the tanks, and a shut-off valve after the system. The system should be thoroughly backwashed before being placed into service. The backwash valves should be set to backwash the media once per week, each tank on a separate day. The backwash line should be piped to a suitable disposal location according to local plumbing codes.

A water sample should be obtained from the sampling tap between the two tanks a few days after installation to confirm that the system is working properly. This initial test should find less than 3 ppb of arsenic, which will indicate the system is adequate. After this, a water sample should be obtained between the two tanks one year after installation and every six months thereafter to determine when the arsenic is breaking through Tank #1. When the arsenic level at this sampling tap reaches 5 ppb, it is time to schedule maintenance of the system which involves media replacement for Tank #1. For a family of three, with typical water use, this type of system will likely need to have the Tank #1 media replaced after two to three years depending on the arsenic concentration. The water treatment installer will remove Tank #1, place Tank #2 into the Tank #1 position, and place a tank with new media into the tank #2 position. The installer

Arsenic Treatment Option Summary

Treatment Type	Preferred	Process & Maintenance	Chemical Use	Waste Generated	Arsenic Species Removed	Typical Media Life	Average Installation Cost	Average Maintenance Cost
Granular Ferric Adsorption Whole House	1st Choice	Simple	None	Low	As3 & As5	2-3 Years	$2,740	$0.67-1.00/day
Gran Ferric Single Tap Cartridges	2nd Choice	Simple	None	Low	As3 & As5	1 year	$365	$0.32/day
Other Adsorption Technologies	Not at This Time	Simple	None	Low	Varies	Varies	Varies	Varies
Anion Exchange Whole House	No	Complex	Salt	High	As5 Only	10 Years	$2,000	$0.27/day
Reverse Osmosis	No	Moderate	Disinfectant	Low	As5 Only	3 Years	$700	$0.33/day

should properly dispose of the used media, which will contain a high level of arsenic. A few days after maintenance, a water sample should be obtained from the sampling tap between the two tanks to confirm that the system is working properly. This test should find less than 3 ppb of arsenic, which will indicate the system is adequate. After this, the water test schedule can be based on the initial results to determine when the arsenic will again break through Tank #1. A water use meter with a warning light indicating when Tank #1 will likely need to be replaced can be installed and greatly reduce the need for obtaining water samples.

The advantages of this system are that it removes both commonly found species of arsenic (As3 and As5), it removes the arsenic from all the water in the home, the arsenic is not returned to the environment via regeneration disposal to a septic system or elsewhere, and it is easy to operate and maintain. If new and improved adsorption media become available in the future, they can be used with the same equipment when the current media needs to be replaced.

Granular Ferric Cartridges: An arsenic water treatment system that removes both As3 and As5 from a single tap in the home is a granular ferric adsorption point-of-use system. The cartridges contain the same media as the whole-house system. These systems should be installed and maintained according to the manufacturer's instructions. They typically produce only two quarts per minute and are used to provide treated water for drinking and cooking only. Cartridges are typically changed once per year. The disadvantages of this type of system are that arsenic exposure may continue in the home from other water uses (e.g., drinking from other taps, bathing, showering, and brushing teeth), and it is not uncommon for homeowners to over run the useful life of the cartridges.

Anion Exchange: An arsenic water treatment system that removes only As5 from water and requires regular maintenance is an anion exchange system. **Because this system does not remove As3, it is not recommended.** It should only be used if As5 has been determined to be the predominant species in the water. Pre-treatment systems to convert As3 to As5 are available, but are not recommended for the average home because of their high cost, complexity, and need for maintenance. The disadvantages of this system are the lack of As3 removal, required maintenance to prevent arsenic dumping into the water, and the disposal of the removed arsenic and regeneration salt to the environment near the home.

Reverse Osmosis: An arsenic water treatment system that removes only As5 and generally from only one tap in the home is a reverse osmosis point-of-use system. This system reportedly does not effectively remove As3 and should only be used if As5 has been determined to be the predominant species in the water**. Because this system does not remove As3, it is not recommended.** If used, these systems should be installed and maintained according to the manufacturer's instructions. Though they can store up to a few gallons of water, they typically produce only 2 quarts of water per hour and are used to provide treated water for drinking and cooking only. The reverse osmosis membrane will need to be replaced every two to three years. The pre and post membrane cartridges should be replaced every 6 months to one year. Pre-softening of the water is recommended when the raw water hardness is greater than 10 grains (170 parts per million). The disadvantages of this type of system are that it only effectively removes As5, arsenic exposure may continue in the home from other water uses (e.g., drinking from other taps, bathing, showering, and brushing teeth), and it is not uncommon for homeowners to over run the useful life of the cartridges and reverse osmosis membrane.

Treatment Costs: A cost survey was conducted for domestic/residential well arsenic water treatment installation and maintenance. The average installation and maintenance costs are shown in the Summary Table on page 1.

Water Heater: In homes with levels of arsenic above 40 ppb, we have found that the water heaters may have accumulated minerals that contain arsenic. These minerals release the arsenic back into the treated water as it passes through the water heater, resulting in the hot water containing arsenic. Therefore, homeowners with an arsenic level greater than 40 ppb should consider replacing their water heater after installing a whole-house treatment system.

More Information on the Internet:

USEPA, 2001, Fact Sheet: Drinking Water Standard for Arsenic, EPA 815-F-00-015: http://www.epa.gov/ogwdw/ars/ars_rule_factsheet.html.

NJDEP, 2001, A homeowner's guide to arsenic in drinking water: http://www.state.nj.us/dep/dsr/arsenic/guide.htm

NJDEP, 2002, Private Well Testing Act Web Site, http://www.state.nj.us/dep/pwta/

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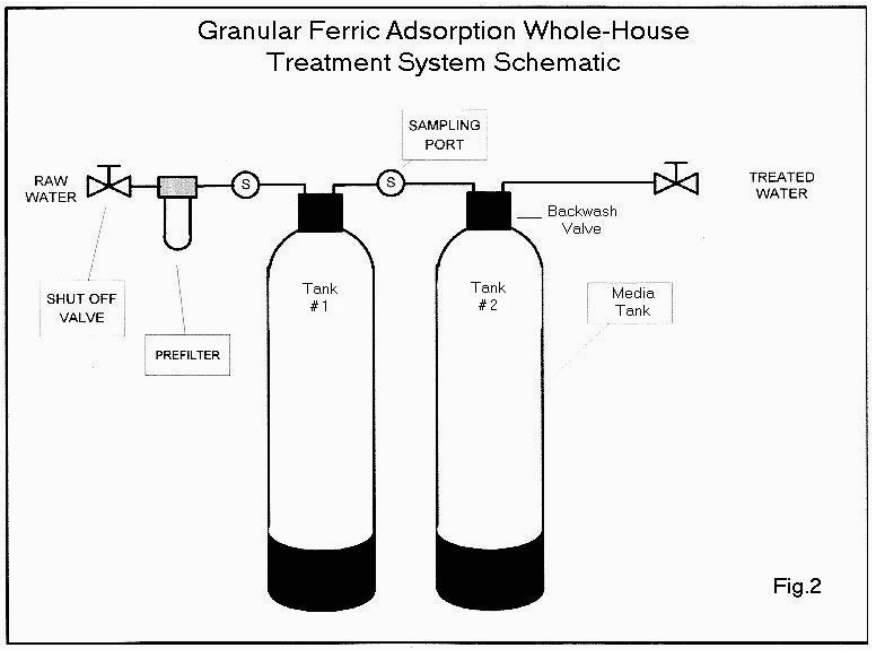

Fig.2